FIG. 1

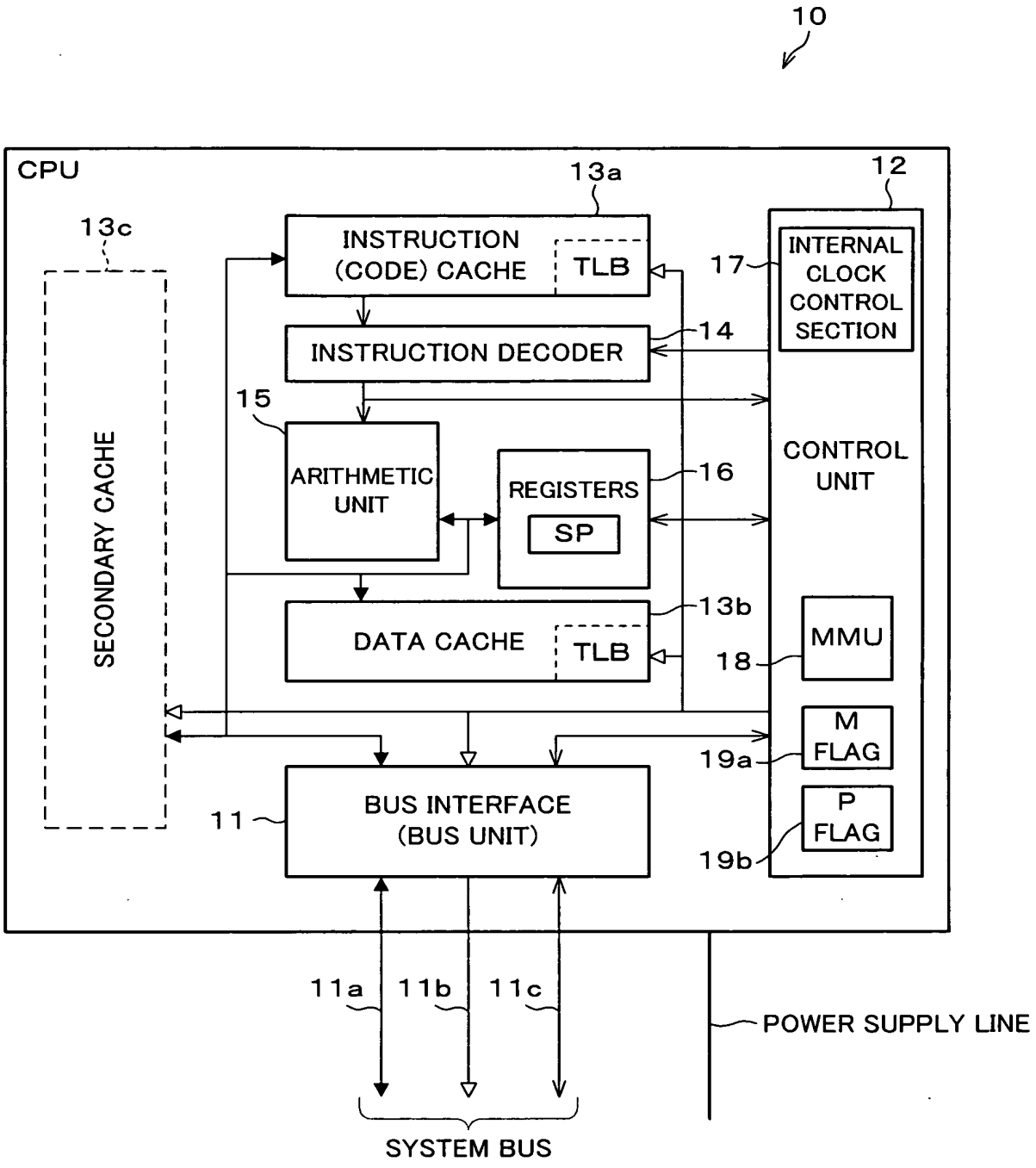

10
CPU
13a
12
13c
INSTRUCTION (CODE) CACHE
TLB
17
INTERNAL CLOCK CONTROL SECTION
INSTRUCTION DECODER
14
15
SECONDARY CACHE
ARITHMETIC UNIT
REGISTERS
SP
16
CONTROL UNIT
DATA CACHE
TLB
13b
MMU
18
M FLAG
19a
P FLAG
19b
11
BUS INTERFACE (BUS UNIT)
11a
11b
11c
POWER SUPPLY LINE
SYSTEM BUS

FIG. 2

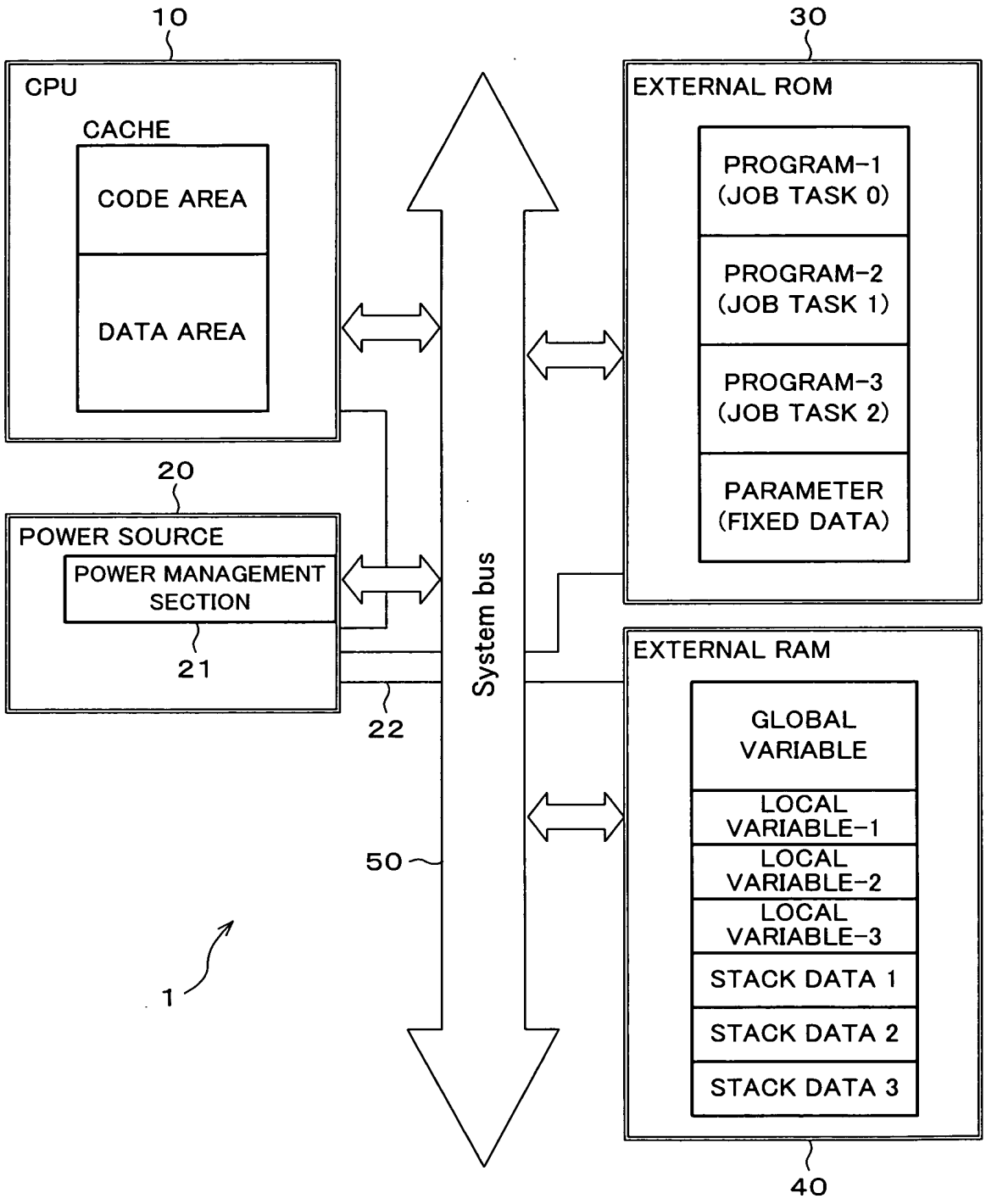

10
CPU
CACHE
CODE AREA
DATA AREA
20
POWER SOURCE
POWER MANAGEMENT SECTION
21
22
System bus
30
EXTERNAL ROM
PROGRAM-1 (JOB TASK 0)
PROGRAM-2 (JOB TASK 1)
PROGRAM-3 (JOB TASK 2)
PARAMETER (FIXED DATA)
EXTERNAL RAM
GLOBAL VARIABLE
LOCAL VARIABLE-1
LOCAL VARIABLE-2
LOCAL VARIABLE-3
STACK DATA 1
STACK DATA 2
STACK DATA 3
40
50
1

FIG. 3 (a)

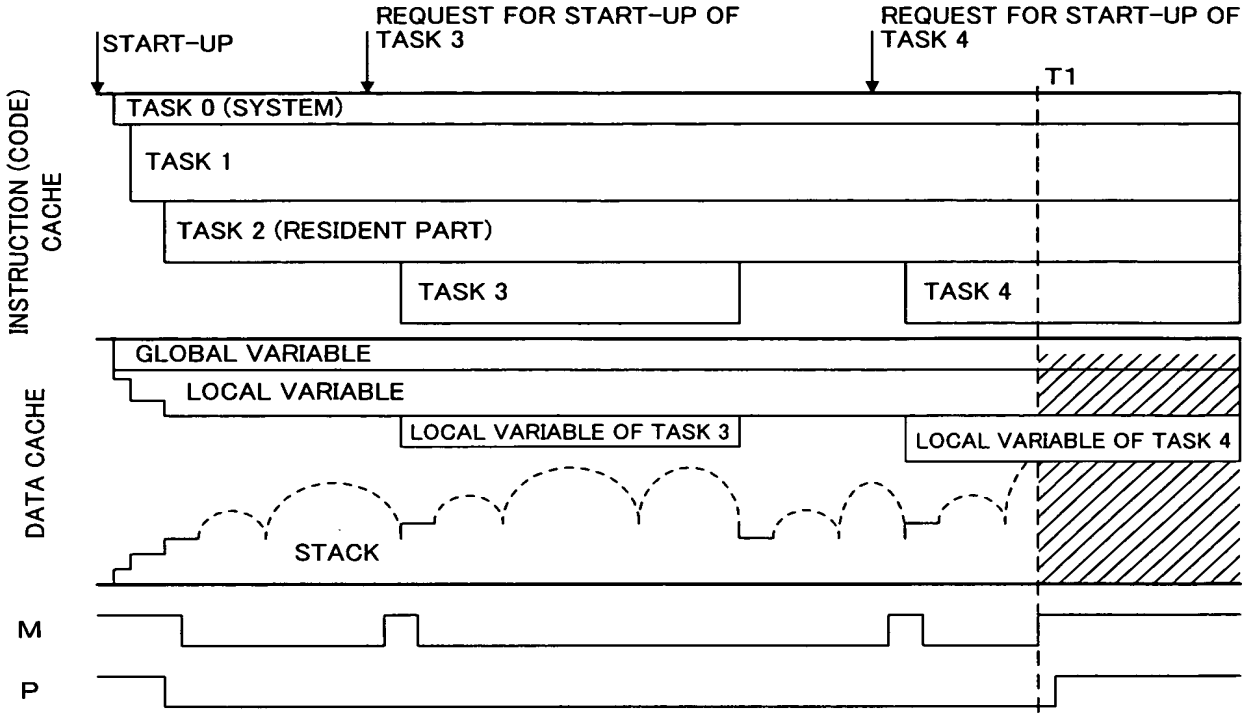

START-UP
REQUEST FOR START-UP OF TASK 3
REQUEST FOR START-UP OF TASK 4
T1
INSTRUCTION (CODE) CACHE
TASK 0 (SYSTEM)
TASK 1
TASK 2 (RESIDENT PART)
TASK 3
TASK 4
DATA CACHE
GLOBAL VARIABLE
LOCAL VARIABLE
LOCAL VARIABLE OF TASK 3
LOCAL VARIABLE OF TASK 4
STACK
M
P

FIG. 3 (b)

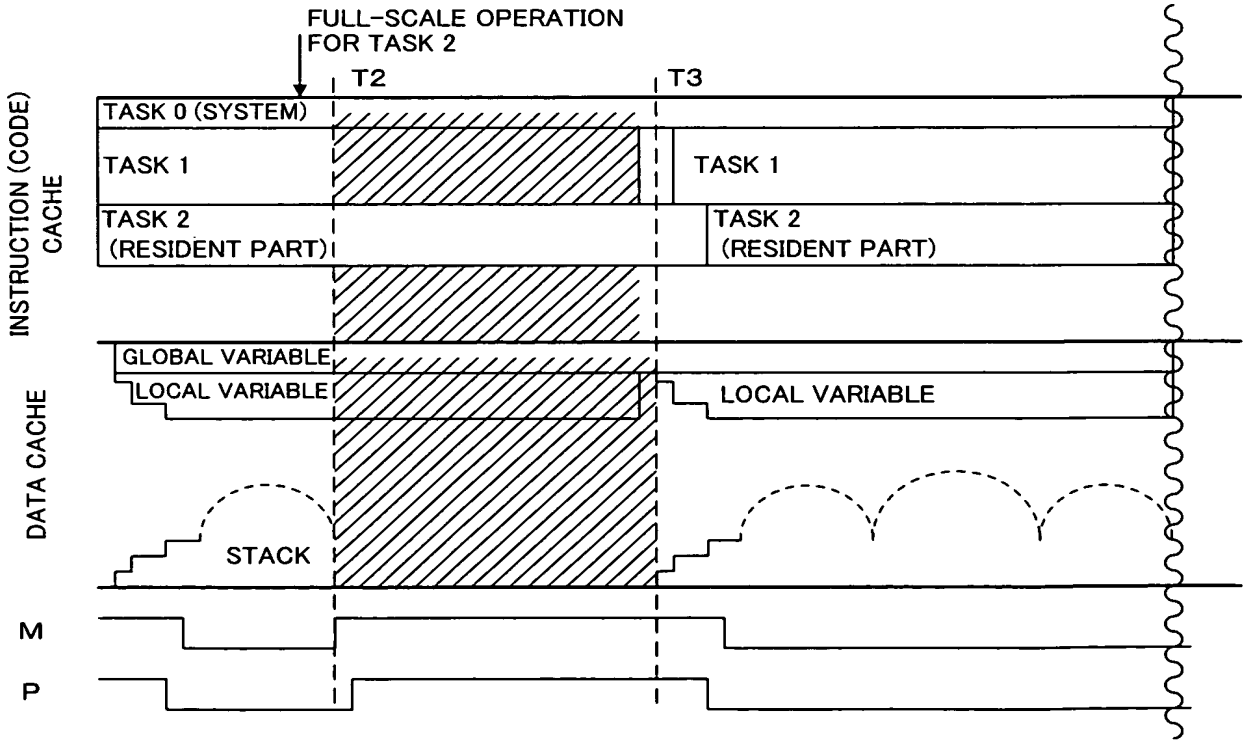

FULL-SCALE OPERATION FOR TASK 2
T2
T3
INSTRUCTION (CODE) CACHE
TASK 0 (SYSTEM)
TASK 1
TASK 1
TASK 2 (RESIDENT PART)
TASK 2 (RESIDENT PART)
DATA CACHE
GLOBAL VARIABLE
LOCAL VARIABLE
LOCAL VARIABLE
STACK
M
P

FIG. 4 (a)

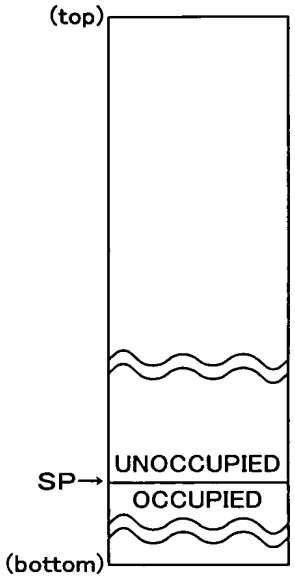


FIG. 4 (b)

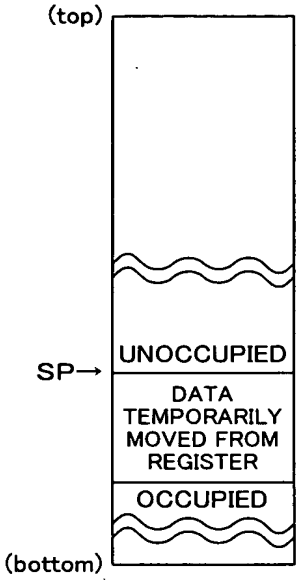


FIG. 4 (c)

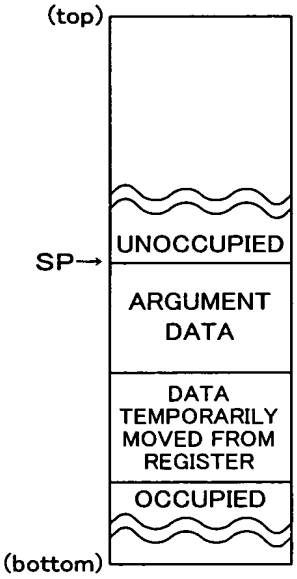


FIG. 4 (d)

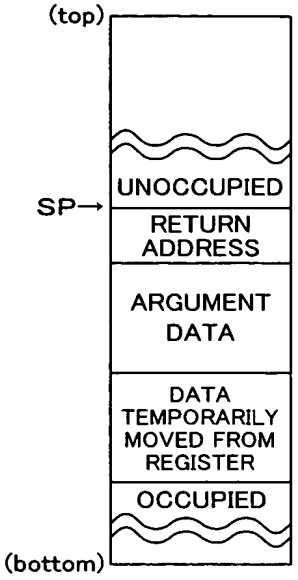


FIG. 4 (e)

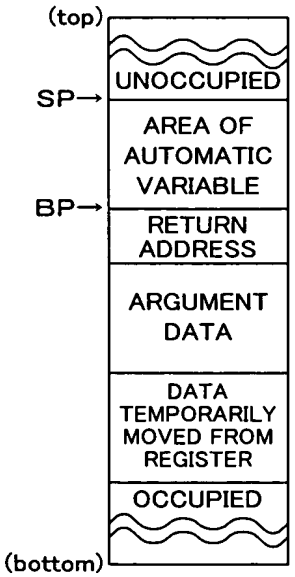


FIG. 4 (f)

CALLING SIDE

```
...
PUSHF
PUSH  BP
PUSH  BX
PUSH  CX
PUSH  DX
...
PUSH  (ARGUMENT 1)
...
PUSH  (ARGUMENT n)
CALL FUNCTION X
ADD   SP  2*n
POP   DX
POP   CX
POP   BX
POP   BP
POPF
...
```

CALLED SIDE

```
MOV  BP  SP
SUB  SP (AUTOMATIC VARIABLE SIZE)
...
(ORIGINAL OPERATION)
...
MOV  SP  BP
RET
```

FIG. 5 (a)

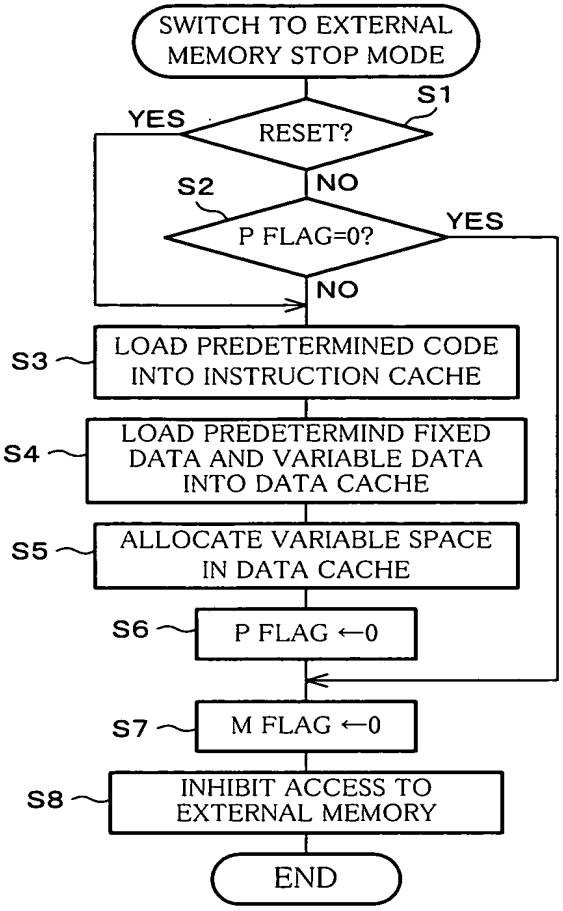


FIG. 5 (b)

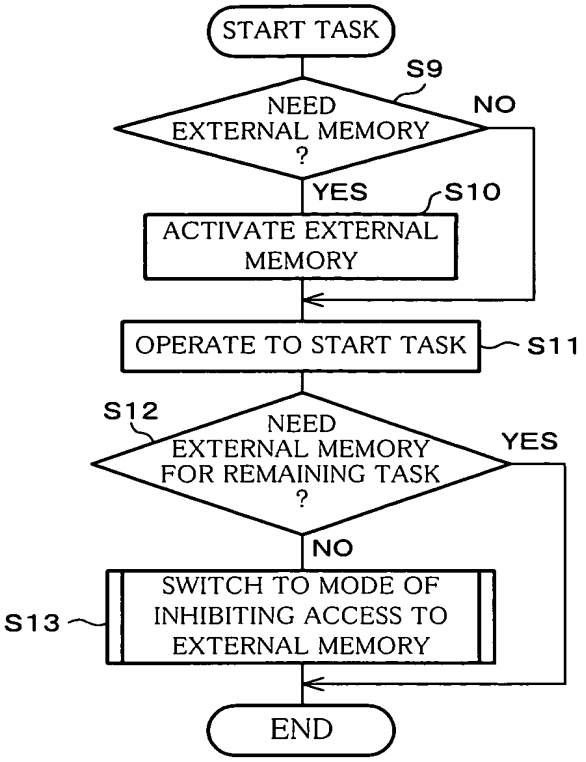


FIG. 5 (c)

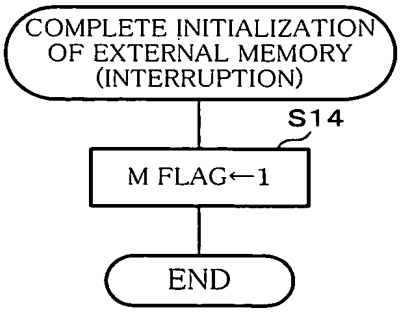


FIG. 5 (d)

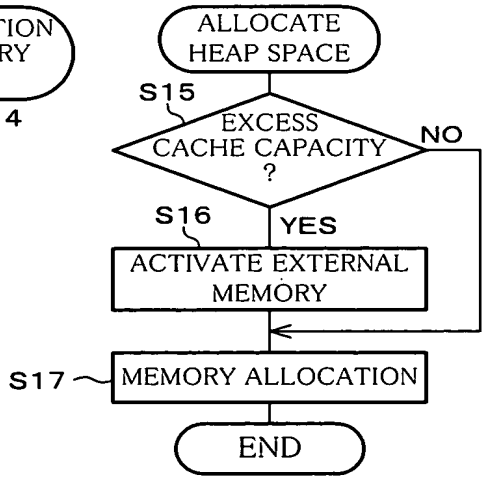


FIG. 5 (e)

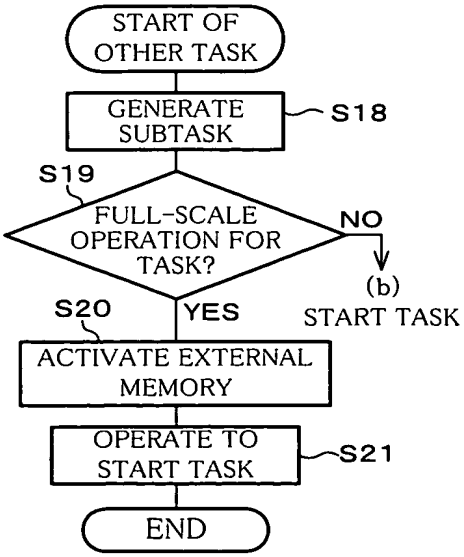


FIG. 6 (a)

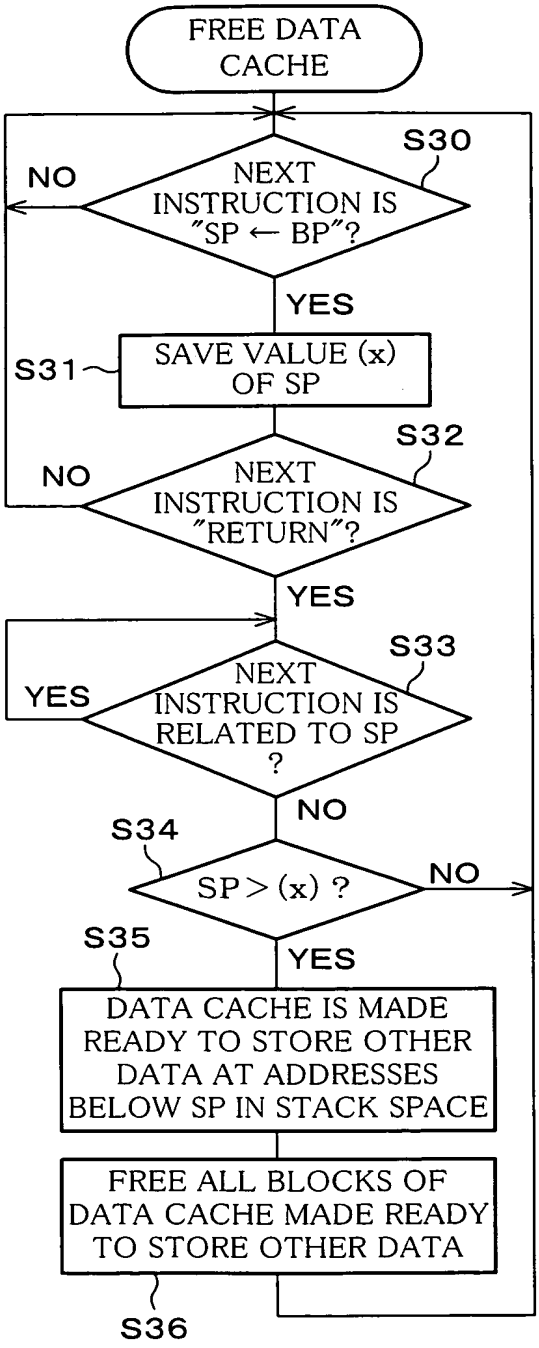

FREE DATA CACHE
S30
NEXT INSTRUCTION IS "SP ← BP"?
NO
YES
S31
SAVE VALUE (x) OF SP
S32
NEXT INSTRUCTION IS "RETURN"?
NO
YES
S33
NEXT INSTRUCTION IS RELATED TO SP ?
YES
NO
S34
SP > (x) ?
NO
YES
S35
DATA CACHE IS MADE READY TO STORE OTHER DATA AT ADDRESSES BELOW SP IN STACK SPACE
FREE ALL BLOCKS OF DATA CACHE MADE READY TO STORE OTHER DATA
S36

FIG. 6 (b)

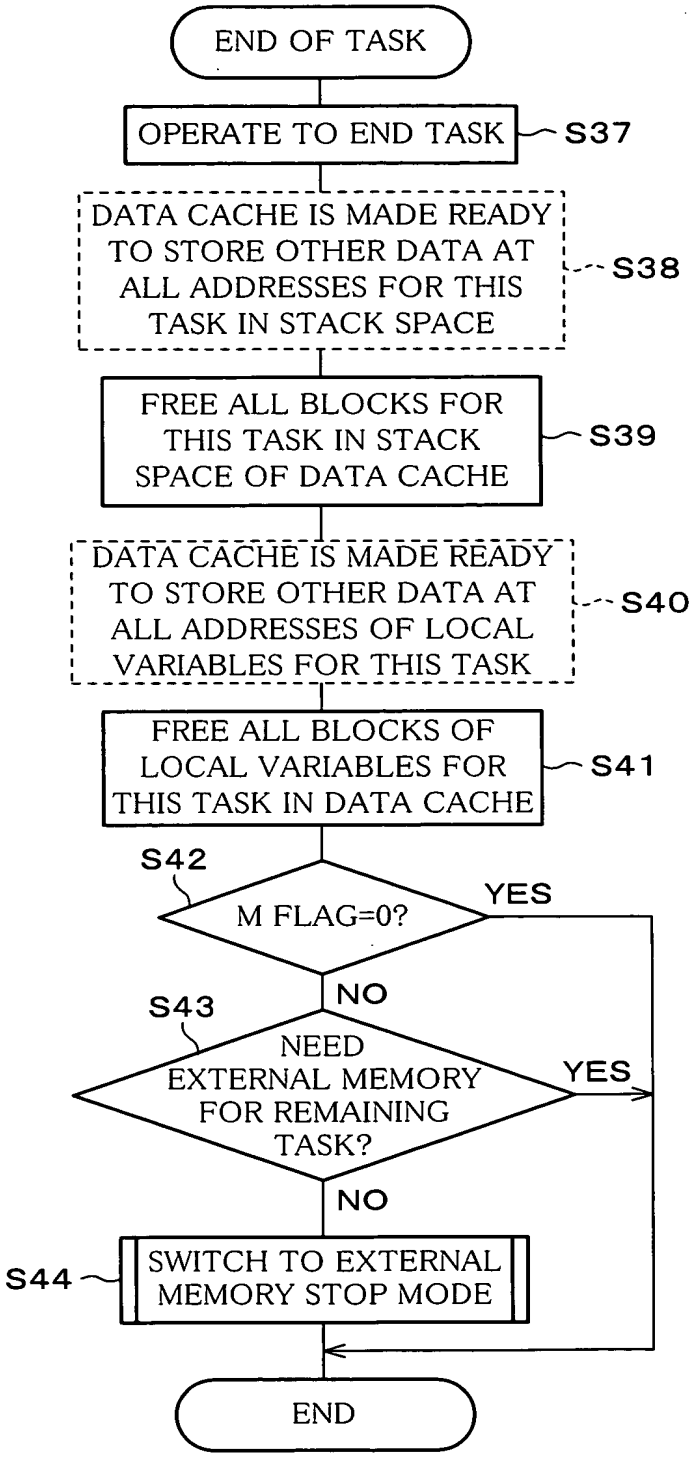

END OF TASK
OPERATE TO END TASK
S37
DATA CACHE IS MADE READY TO STORE OTHER DATA AT ALL ADDRESSES FOR THIS TASK IN STACK SPACE
S38
FREE ALL BLOCKS FOR THIS TASK IN STACK SPACE OF DATA CACHE
S39
DATA CACHE IS MADE READY TO STORE OTHER DATA AT ALL ADDRESSES OF LOCAL VARIABLES FOR THIS TASK
S40
FREE ALL BLOCKS OF LOCAL VARIABLES FOR THIS TASK IN DATA CACHE
S41
S42
M FLAG=0?
YES
NO
S43
NEED EXTERNAL MEMORY FOR REMAINING TASK?
YES
NO
S44
SWITCH TO EXTERNAL MEMORY STOP MODE
END

FIG. 7 (a)

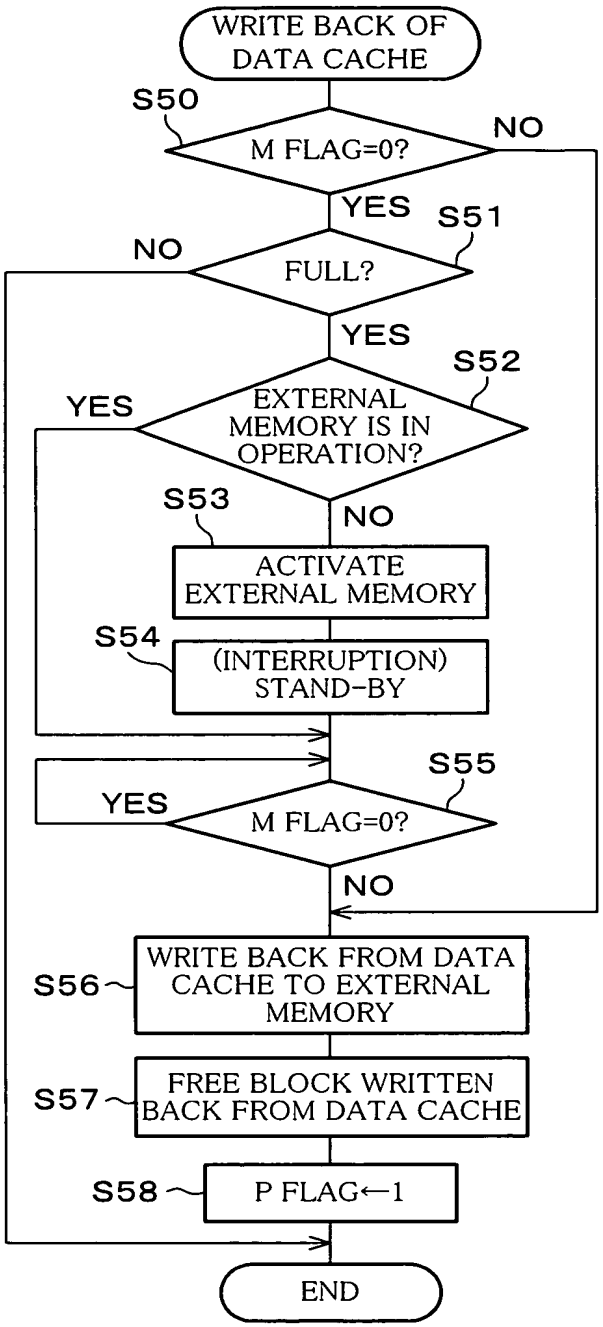
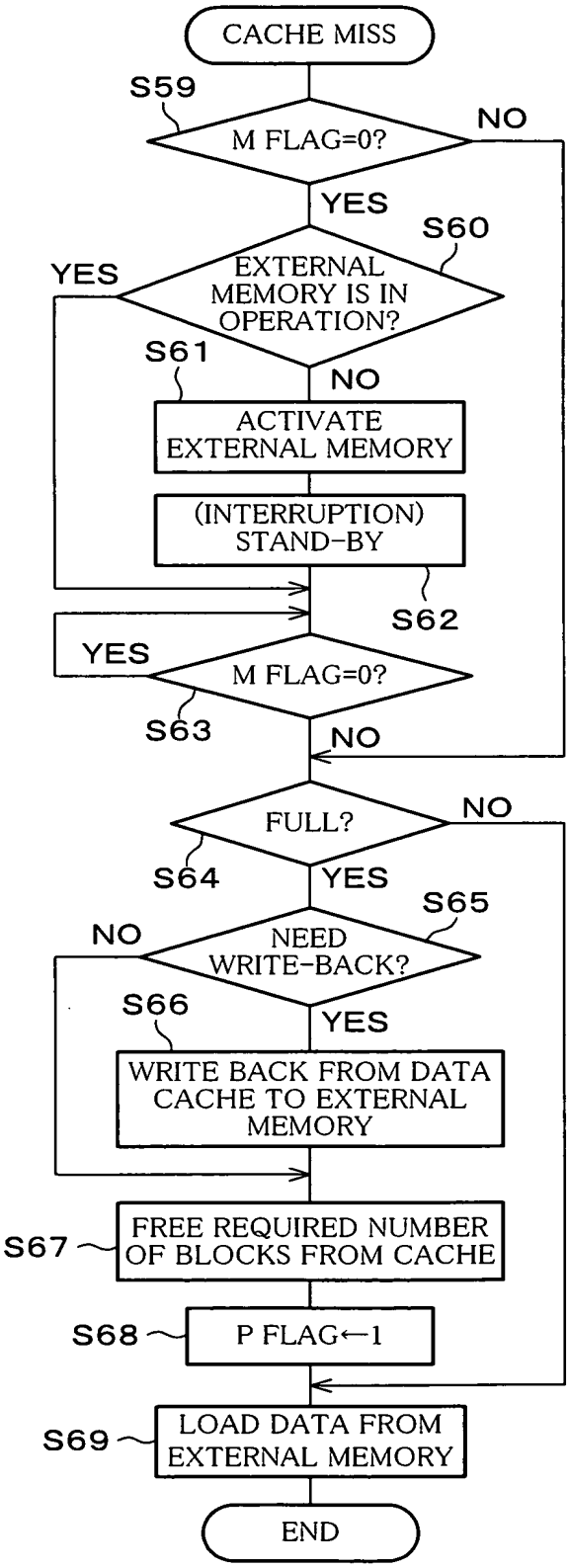

WRITE BACK OF DATA CACHE
S50
M FLAG=0?
NO
YES
S51
FULL?
NO
YES
S52
EXTERNAL MEMORY IS IN OPERATION?
YES
NO
S53
ACTIVATE EXTERNAL MEMORY
S54
(INTERRUPTION) STAND-BY
S55
M FLAG=0?
YES
NO
S56
WRITE BACK FROM DATA CACHE TO EXTERNAL MEMORY
S57
FREE BLOCK WRITTEN BACK FROM DATA CACHE
S58
P FLAG←1
END

FIG. 7 (b)


CACHE MISS
S59
M FLAG=0?
NO
YES
S60
EXTERNAL MEMORY IS IN OPERATION?
YES
S61
NO
ACTIVATE EXTERNAL MEMORY
(INTERRUPTION) STAND-BY
S62
YES
M FLAG=0?
S63
NO
FULL?
NO
S64
YES
S65
NEED WRITE-BACK?
NO
S66
YES
WRITE BACK FROM DATA CACHE TO EXTERNAL MEMORY
S67
FREE REQUIRED NUMBER OF BLOCKS FROM CACHE
S68
P FLAG←1
S69
LOAD DATA FROM EXTERNAL MEMORY
END